

Oral and postcranial bone-gain patterns at 2-year recall. C.F. HILDEBOLT, T.K. PILGRAM, N. YOKOYAMA-CROTHERS, M. DOTSON, J. MUCKERMAN, J. HAUSER, S. COHEN, E. KARDARIS, M. VANNIER, R. CIVITELLI (Washington Univ., St. Louis), J. HANES, M. SHROUT (Medical College of Georgia, Augusta).

The objective was to study the relationship between oral and postcranial bone in postmenopausal women. In a double-blind, longitudinal study of 135 postmenopausal women (mean age = 59 ± 6.2), (1) alveolar crest height (ACH), (2) lumbar spine and femur bone mineral densities (BMDs), and (3) smoking habit were tested for associations. Inclusion criteria were at least 10 teeth, no periodontal pocket ≥ 5 mm, and good health. ACH distances were measured from digital images of dental radiographs. BMDs of the proximal femur and lumbar spine were determined with dual X-ray absorptiometry. Women received daily calcium (1000 mg) plus vitamin D supplements and randomly received hormonal replacement therapy (HRT, estrogen/progesterone) or placebo. Measurement changes from baseline to year-1 and year-2 recalls were entered into analyses.

For 52 women on ERT, the mean increase in the various BMDs was +3.5% (range = +2.7% to +4.2%) and for ACH +6.0%. For 38 women on placebo, the corresponding values were BMD = + 0.6% (0.5% to 0.7%) and ACH +2.9%. For the 79 nonsmokers, the mean change for BMD was + 1.9% (1.6% to 2.3%) and for ACH +4.1%. For the 11 smokers, the overall mean change in BMD was +4.5% (2.7% to 6.6%) and for ACH +10.3%. The BMDs and ACH were positively correlated for all BMD sites, with that for the trochanter being statistically significant ($P < 0.05$). At the trochanter, the mean change in BMD for 34 nonsmokers receiving ERT was +3.2%. The corresponding change in ACH was +5.9%. For the 34 nonsmokers on placebo, the mean change in BMD was 0.0% and in ACH +1.1%.

The general trend was for patients on ERT to gain both BMD and ACH. This effect was most pronounced in smokers. On average all patients gained ACH. This gain may be attributable to good dental care, calcium supplementation, ERT, or a combination of these factors.

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Mandibular ramus flexure and determination of sex. C.A. HILL, University of Kansas, Lawrence, KS 66045.

Mandibular ramus flexure has been proposed as a highly reliable technique for determining sex of adult humans (Loth and Henneberg, 1996). In an independent, blind test of the technique, data were collected from the Hamann-Todd Collection (Cleveland Museum of Natural History). The sample ($n=158$) was comprised of 17% African-American females, 24% African American males, 17% European-American females, and 42% European-American males. The left and right sides

from both medial and lateral views of each mandible were separately scored and no notable asymmetry of mandibular ramus flexure existed. The data show that mandibular ramus flexure predicts sex with an accuracy of 82.3%, which is substantially less than Loth and Henneberg's overall accuracy of 94.2%. Moreover, the technique's accuracy is significantly different for males and females with 55.5% correct for African-American females, 67.8% for European-American females, 92.5% for European-American males, and 94.7% for African-American males.

Sixty mandibles of juveniles and young adults (3 years $< x < 23$ years) were also examined for flexure. Children and adolescents did not show the mandibular ramus flexure typical of adults. Within the sample, flexure appears in males around 17 to 19 years.

These results suggest that mandibular ramus flexure is generally reliable in predicting sex (especially for males), but accuracy is not as high as reported.

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Are we asking the right questions about porotic hyperostosis? M.C. HILL, Department of Anthropology, University of Massachusetts/Amherst.

A major aspect of epidemiology research is the reexamination of descriptive data with current, state of the art techniques. Returning again and again to the same observation is, in part, a validation of both methodology of analysis and conclusions about disease etiology. A case in point is the pathological condition known as porotic hyperostosis. Despite over 100 years of research showing high correlation between these lesions on the cranial vault and various forms of anemia, analysts continue to argue over the meaning and interpretation of the correlation. Adding to the complexity of the debate are the many different suggestions of "true" cause or source of anemia. The more recent interpretations that apply the principle of the osteological paradox, stating that anemia is an adaptive response to pathogens that compete with the hosts for iron, are gaining favor, and are even being promoted in more popular venues.

This research tests the premise that anemia is adaptive, using 100 individuals from three protohistoric sites in west-central Alabama. Individuals with evidence of anemia and/or infection were evaluated using the standardized scoring methods developed by the Paleopathology Association. Demographic results show that anemia is not adaptive, and that porotic hyperostosis is correctly categorized as a metabolic disorder as shown by its association with other markers of metabolic dysfunction, specifically growth failure. More subtle, less frequently mentioned skeletal abnormalities are also discussed.

The broadly applied use of the term "adaptive" in discussions of physiological conditions that are pathological is a perversion of the concept. It suggests a misunderstanding of one of the very

basic tenets pervasive in most anthropological literature, as well as other hard-science and soft-science disciplines. An adequate understanding of anatomy and physiology, particularly concerning the actual, medical definition of anemia, will help to unravel the factors that cause the condition.

The bones from Benjamin Franklin's house at Craven Street, London. S.W. HILLSON¹, H.A. WALDRON¹, L.A. MARTIN¹ and B. OWEN-SMITH². ¹Institute of Archaeology, University College London, 31-34 Gordon Square, London, WC1H 0PY. ²Friends of Benjamin Franklin House, 36 Craven Street, London.

Benjamin Franklin lived at 36 Craven Street, near Charing Cross Station in London, between AD 1757 and 1775. In December 1997, during renovation work, builders working in the basement found human bones representing several adults and children. Further excavations in May 1998 unearthed many more human remains, together with a variety of other animals, glassware, pottery and metalwork. The remains were fragmentary and commingled, with a few articulated thoracic elements and feet, and the complete skeletons of a dog and a baby. All had systematically been deposited in a carefully constructed pit, against the back wall of the house in what had originally been the garden. Many bones bore clear saw-marks; skulls were typically sectioned and a number displayed the circular cuts made by trepanning. The surgical nature of the cutmarks strongly suggests that the bones resulted from the work of William Hewson, an anatomist who was Franklin's lodger at Craven Street. Hewson was a student and partner of the anatomist William Hunter and set up his own anatomy school in 1772, only to cut himself dissecting and die of septicaemia in 1774. He is best remembered for demonstrating the lymphatic system of the turtle, using mercury. One of his turtle specimens is preserved in the Hunterian Museum of Glasgow University, and the recent Craven Street excavations also revealed turtle remains, associated with mercury in the soil.

This site provides a unique opportunity to investigate an important stage in the development of anatomical science, before the Anatomy Act of 1832 made legal provision for the dissection of human bodies. It also has an important role in understanding the training of those who went on to found the medical schools of North America.

Stresses, strains and adaptive remodelling in trabecular bone: a finite element approach. J. HIRSCHBERG, N. MILNE and C. E. OXNARD, University of Western Australia, WA, 6907, Australia.

Biomechanical studies of simulated tendon/bone junctions reported last year using the Fast LaGrangian

Analysis method of finite element analysis, imply that situations can exist where the balance of stresses in bone and tendon produce a uniform value of tangential stress along the attachment surface. This is so whether the surface of attachment is a tubercle or a pit. One implication that can be drawn is that uniformity of stress at a surface may be a parameter related to adaptive bone remodelling.

This same technique is here applied to models of the trabeculae beneath cortical bone. The first model attempts to investigate stresses in a single trabecula loaded eccentrically (eg where a tendon pulls at an angle). In such a model the trabecula exhibits the expected bending stresses. When, however, the trabecula is then computationally remodelled so as to produce a uniform value of tangential surface stress over its surface (as in the examples of the pit and the tubercle above) then indeed, the trabecula realigns along the directions of the impressed loads. However, the intermediary stages in the remodelling process are counter intuitive – the remodelling starting from the centre of the trabecula and not at the more highly stressed ends. A further model with four orthogonally arranged trabeculae produces a similar result.

Three sets of orthogonal trabeculae (24 trabeculae in all) also come to be re-positioned so that they become aligned with the impressed mechanical loads. In this case, however, the remodelling starts in all parts of the model at the same time. This implies that this model is a better representation of what may occur in life in real bone when remodelling of trabeculae occurs.

These studies may aid in our interpretation of function from trabecular arrangements in the bones of living and fossil forms. They may also have implications for the remodelling that occurs in trabecular bone in many clinical situations.

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Use of baboons as an animal model to study heart disease. J.E. HIXSON, Department of Genetics, Southwest Foundation for Biomedical Research, San Antonio, TX 78245

Baboons provide a valuable animal model of heart disease because of their close physiological and phylogenetic relatedness to humans, and because they can be controlled for both environmental factors (diet) and genetic factors (breeding) that often confound studies in human populations. Over the years, we have used several forms of genetic analysis to identify genetic factors that influence known risk factors of heart disease such as serum levels of lipids, lipoproteins, and apolipoproteins. Our target population is a large colony of pedigreed baboons that are maintained on a low cholesterol and low fat diet, and subjected to two dietary challenges (high cholesterol high fat, low cholesterol high fat). Initially, complex segregation analysis was used to detect major genes that influence several important risk factors, including serum levels of HDL-C, LDL-C, apoA-I, HDL subfractions (HDL-1, HDL-2), Lp(a), and LDL-C response to dietary fat and cholesterol. Later studies used candidate gene polymorphisms to detect associations with lipoprotein phenotypes including *LDLR* with LDL-C and apoB levels,

APOA1 and *APOA4* with HDL-C and apoAI levels, and *LCAT* with *LCAT* activities and HDL-C levels.

Recently, we began a genome-wide search to identify new genes that influence lipoprotein phenotypes, using microsatellite markers distributed at 10 cM intervals across the baboon chromosomes. Using this strategy, we have identified a quantitative trait locus (QTL) on chromosome 18 that influences serum levels of HDL-C and subfraction HDL-1 on the high cholesterol high fat diet (LOD = 8.2). This region contains a strong positional candidate gene called Familial Intrahepatic Cholestasis 1 (*FIC1*) that may be responsible for this QTL detected by random markers. We have identified new polymorphisms in baboon *FIC1* for direct tests of association with HDL-related phenotypes. In order to improve our ability to detect QTLs in our genome search, we have established new breeding groups of baboons consisting of single sires (selected by lipoprotein phenotype) mated with many dams that are closely related to each sire. The resulting inbred progeny will contain large chromosomal regions that are autozygous (identical by descent within an individual), providing increased statistical power to detect QTLs that account for as little as 10% of the total variation for a particular phenotype. Using these new strategies, we expect the baboon model to continue to provide significant contributions to understanding of the genetic basis of susceptibility to heart disease.

Shape Analysis of *Australopithecus* Molars from Sterkfontein, South Africa
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Previous studies show high coefficients of variation within the Sterkfontein tooth sample, the implications of which are unclear. Basic metrics are the foundation for most of the debate surrounding this material. A coronal view of molar crown morphology shows differences, aside from traditional characters, that vary between taxa. Euclidean distance matrix analysis was used to quantify these shape differences. Coronal profiles of mandibular molars from Sterkfontein were studied to see if the morphological differences identified in this view contribute to our understanding of the high CV.

Unworn modern human, chimpanzee, gorilla, and Sterkfontein (N=19) lower molars were sorted by tooth row position. Significant shape differences are found in the extant samples both between M_1 s and M_2 s and between species. Those differences due to tooth row position include distance between the protoconid and metaconid cusp tips and the amount of bulging on both the buccal and lingual sides. The Sterkfontein M_1 s and M_2 s show the same significant pattern of differences in intercusp tip distance and the buccal and lingual bulging pattern as the extant intraspecific comparisons. Though the statistical strength for some of these morphological differences is not as strong in the Sterkfontein sample as for the extant species, perhaps due to the smaller sample size, the pattern of variation

between M_1 s and M_2 s is the same. When the Sterkfontein sample is divided by B-L width alone, a comparison between the two halves still only evinces differences which if seen in extant taxa would be attributed just to tooth row position. Consequently, this particular suite of dental traits does not reject the hypothesis of only one species at Sterkfontein. The high CV for this sample may result from time-averaging within the cave deposits.

This material is based upon work supported under a National Science Foundation Graduate Fellowship.

An SEM study of microwear on mandibular molars of Japanese monkeys (*Macaca fuscata*). T. HOJO, Department of Anat. & Anthropol. Sch. of Med., Univ. of Occup. & Envir. Hlth, Kitakyushu 807-8555, JAPAN; Phone:81-93-691-7232; FAX:81-93-691-8544; email:hojo@med.uoeh.ac.jp

SEM analyses of dental microwear showed striations and pits on the heavily worn occlusal surfaces of P_3 s of Japanese monkeys (Hojo, 1996, 1997). In the present SEM study regional variations of microwear patterns on their enamel surfaces of heavily worn mandibular molars of five Japanese monkeys (*Macaca fuscata*) were analysed. High resolution dental impressions were taken from these mandibular molars using "President Light Body" polyvinylsiloxane (Coltene/Whaledent). Araldite-epoxy resin casts made from the impressions were examined under an ABT SX-40A scanning electron microscope, and micrographs were taken from the occlusal and buccal surfaces of M_1 s, M_2 s, and M_3 s, at the magnification ranging from 6X to 500X. The diet of these five Japanese monkeys consisted of slightly muddy unskinned sweet potatoes and some insects. As for M_2 , microwear patterns on the inner region of the protoconid looked like those of almost the same facet 9 of *Cebus apella* as described by Teaford (Scanning Microsc. 2:1149-1166, 1988), but the mean diameter of the pits in this study was larger than that of *Cebus apella*. These regions were crushing facets of M_2 . In the present study, the definition of regions was almost the same as that of Gordon (AJPA, 59:195-215, 1982). A male showed many striations with large pits about 70 μ m in the mean diameter on the protoconid-a facet (the distal part of the protoconid) of M_2 . Pits on the hypoconid of M_3 in two male samples were more in number than those on the protoconid-a facet of M_2 . As for M_3 , there were many large pits on the hypoconid close to the facet 9. The mean diameter of pits on the hypoconid with a few striations on M_3 was about 75 μ m, and those striations were wider than those on the same facet 9 of *Cebus apella*. More than 30 parallel striations on the entoconid of the same M_3 were more than 1000 μ m in length. On this region there were a few and small pits about 10 μ m in the mean diameter. Thin parallel striations on the entoconid were long and regular. Many parallel striations on the metaconid of M_1 s, M_2 s, M_3 s were longer and wider than those on the entoconid.

Did Australopithecines have inflated brains? R.L. HOLLOWAY, S. MARQUEZ, D. BROADFIELD, and M. YUAN, Department of Anthropology, Columbia University, NY, NY 10027, Mount Sinai School of Medicine, NY, NY 10029

In a recent *Science* commentary (12 June, 1998), Falk asserts that many of the fossil australopithecine cranial capacities have been inflated. Sts71, a gracile australopithecine from Sterkfontein, S. Africa, is depicted by Conroy *et al* (*Science*, same issue) as much smaller than it's published 428 cc value, and Falk suggests a volume of 370 cc based on pouring water into a cast of this hominid. It is shown here that most of the cranial capacity determinations made by this author in the '60's and 70's, were in fact deflationary. The Sts71 specimen in particular, was originally published as 480 cc by Tobias. This specimen shows a considerable amount of plastic and other deformation which both Falk and Conroy *et al* have thus far ignored. In addition to showing the effects of these distortions on the cranial capacity of Sts71, we show that the overall metric dimensions of Sts71, compared with Sts5, makes it extremely doubtful that Sts71 could be some 115 cc smaller than Sts5 (485cc).

It is of course possible that some estimates of cranial capacity are too high (or low). Good examples requiring re-analysis might be OH24, OH13, MLD37/38, Sts19/38. Each endocranial volume should be considered on its own merits and not by blanket assertions of inflation.

We conclude that claims of a revolutionary change in brain evolution are premature at best, and that it would be wise to take distortion into consideration when calculating cranial capacities, whether one is pouring water or analyzing modern scans.

Fitting Mixture Distributions to Estimate Adult Demographic Structure in Skeletal Samples. RD HOPPA (Max Planck Institute for Demographic Research, Rostock, Germany) SR SAUNDERS & P MACDONALD (McMaster University, Hamilton, Canada)

Palaeodemographic reconstructions of past populations are necessarily dependent upon accurate determination of age-at-death and sex distributions within skeletal samples. The accuracy and reliability of age estimation techniques in particular, has been a central criticism of palaeodemography, particularly with respect to the under-estimation of older adults. The current study explores a fitted mixture distributions technique for estimating adult demographic structure in a documented skeletal sample. Fitting mixture distributions is a robust statistical procedure that utilizes a small training sample from which to build the most likely demographic distribution from the unknown sample.

This pilot study was conducted on the skeletal sample derived from the 19th century St. Thomas' Anglican Church Cemetery. A small subgroup of individuals of known age is associated with the sample. All adults from the sample with preserved pubic symphyses were scored using the Suchey-Brooks method. The data were divided into 6 components

for each pubic symphysis indicator stage, and seven 10-year intervals for age. Demographic profiles were estimated from the frequency of individuals in each of the six stages. Two training samples were utilized to estimate the demographic structure from these data; one extrinsic (the pubic symphysis reference sample) and one intrinsic (the subsample of individuals of known age). In order to overcome problems of a small intrinsic training sample and a larger but potentially less applicable extrinsic training sample, the data were run first using the extrinsic training sample to estimate all parameters of the mixture. The procedure was then repeated with the intrinsic training sample, re-estimating as many parameters as possible while holding the others fixed at the values fitted to the extrinsic data. The final distribution obtained represents the proportion of the sample estimated in each ten-year interval from 20 to 70+ years of age using the fitted mixture distribution technique.

Although this procedure does appear to better address the issue of aging older adults, the problem of reference sample mimicry is still an issue to be resolved.

Computer program for sex diagnosis of the human pelvic bone based on probabilistic approach. F. HOUËT, J. BRUZEK and P. MURAIL, UMR 5809 CNRS, Department of Anthropology, University Bordeaux 1, Avenue des Facultés, 33 405 Talence cedex, France.

Sex diagnosis from the skeleton can successfully be conducted from the pelvic bone using metrical data by the way of discriminant functions. Some of these functions are non population-specific when they take into account the sexual dimorphism as a whole. However, it is still possible to improve the objectiveness and the reliability of sex assessment with computing and statistical tools.

We propose here a computer program for sex assessment in Caucasoid past populations based on the combinations of linear pelvic measurements. The initial material consists of a large sample of known-sex individuals (N = 355 pelvic bones) originated from three European populations dating from 18th to 20th centuries (Spitalfields, British Museum, London; Université Paris VII, Paris; Coimbra, Instituto de Antropologia, Coimbra). We elaborated reliable and non population-specific discriminant functions applicable to the complete preserved pelvic bone as well as to partially preserved bone.

Sex of a new specimen is assessed using posterior probability (p.p.) depending on the statistic parameters of the whole reference sample. When the chosen threshold of p.p. is 0.95, the successful rate of sex determination is very closed to 100%.

This tool is useful since, in one hand, it allows sex diagnosis from bad preserved pelvic bone and, in the other hand, the chosen p.p.'s threshold is adaptable to one's objectives, for example in forensic anthropological cases.

Interactions between mantled howling monkeys (*Alouatta palliata*) and neotropical birds in a fragmented forest habitat on Ometepe Island, Nicaragua.

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Interactions across animal taxa and mixed-species assemblages are known to improve the survival of the participating species, and can be found throughout the tropics. This study investigates opportunistic ecological interactions between mantled howling monkeys (*Alouatta palliata*) and neotropical bird species in the study area, e.g. banded-wren (*Thryothorus pleurostictus*), white-throated magpie-jay (*Calocitta formosa* f.) and turkey vulture (*Cathartes aura*). Forty-one hours of bird surveys and monkey contact hours were carried out in two separate fragmented blocks of a seasonal dry-forest near the Ometepe Biological Field Station during July-August 1998, in the wet season. The presence, absence, calling frequency and activity between these two animal taxa were analyzed for plots with a 30 m radius, identified as the "soundscape". This radius was chosen since the forest does always allow for oral, but not for visual observations beyond 30 m. These plots were equally investigated over the whole day, occurrence of wind was identified also. Plots were compared where mantled howling monkeys were present versus control plots where mantled howling monkeys were absent. The masking effect of wind within the soundscape proved to be relevant for calls of mantled howling monkeys and birds. Birds were not observed to be feeding on insects or fruits, made available to them by mantled howling monkeys, e.g. by discard-feeding of fruits or chasing off insects. Significant results are presented for mantled howling monkeys behavior (howling, moving, feeding, resting) and presence and absence of birds of prey and songbirds. Banded-wrens were found to be stimulated to start singing by calling mantled howling monkeys. Except for turkey vultures no other predators (birds of prey, snakes, large mammals) were observed in the "soundscape" when howling monkeys were present. Implications of the observed predator-free "soundscape" for mantled howling monkeys and birds are discussed.

Skeletal growth in modern humans and the African apes. L.T. HUMPHREY, Human Origins Group, Department of Palaeontology, The Natural History Museum, Cromwell Road, London SW7 5BD

Modern humans are characterised by a prolonged period of growth and maturation compared to chimpanzees and gorillas. The extent to which different developmental systems might vary in terms of relative advancement or retardation has not been fully explored, and could have important implications for understanding developmental processes in fossil taxa. This paper examines the relationship between skeletal growth, tooth emergence and estimated chronological age in humans, chimpanzees and gorillas. Skeletal growth is assessed in terms of the percentage of

adult size attained at different chronological ages and stages of dental development, and is determined from equations describing the growth patterns of a series of skeletal dimensions in each species.

The results demonstrate that humans differ from the African apes in their rate of attainment of adult skeletal size relative to both estimated chronological age and the emergence of individual teeth. Humans are advanced over chimpanzees and gorillas in the percentage of adult size attained at the species specific ages of emergence of the first, second and third permanent molars, although the differences between the three species diminish with the emergence of successive molars. Differences in the percentage of adult skeletal size attained at the same chronological age are lower. During the first few years, humans have attained a higher percentage of adult size than chimpanzees or gorillas in most variables, but this situation is reversed during the later stages of growth. Differences between gorillas and chimpanzees in the percentage of adult size attained at equivalent stages of tooth emergence or estimated chronological ages are small, indicating that differences in adult size are mainly the result of variation in growth rates rather than in the duration of growth.

These findings show that the extent to which different developmental systems have been affected by an overall lengthening of the developmental period during human evolution is variable, and that it would be unwise to draw inferences about the rate of development of fossil taxa based on evidence from a single developmental system.

History and demography of the Robert J. Terry Anatomical Collection. DAVID R. HUNT, Department of Anthropology, NMNH, Washington, DC 20560-0112. HUNT.DAVID @ NMNH.SI.EDU

The Robert J. Terry Anatomical Collection is one of the premier collections in the U.S. used for skeletal biological research. It consists of 1728 human skeletons (461 White Males, 546 Black Males, 323 White Females, 392 Black Females, 5 Asiatic Males) with age of death ranging from 16 to 102 years, and date of birth from 1822 to 1943. Based on information from the morgue records (containing name, sex, age, ethnic identity, cause and date of death), distribution of the collection by age decade is as follows:

Decade	2	3	4	5	6	7	8	9	10	11
BM	20	83	114	104	110	70	30	8	2	0
WM	7	10	30	77	107	129	80	15	0	0
BF	21	53	61	66	58	52	45	17	6	2
WF	13	7	11	29	56	80	6	42	4	0

In the skeletal inventory, damaged or absent bones, pathological and normal osteological variants are defined. Approximately 60% of the collection has associated anthropometric measurements and cadaver photographs. There are 836 plaster death masks and 1078 hair samples curated with the collection.

Following mentor Dr. George S. Huntington (College of Physicians & Surgeons, NY, 1886-1924), Dr.

Terry (Washington Univ. Medical School, 1899-1941) began to collect skeletons from cadavers in the early 1900's. Uniform protocol was established for cataloging, maceration and storage. Skeletons came from soft tissue dissections where only the calvarium and ribs were sometimes cut. Mildred Trotter continued the collection from 1941 - 1967; she strove to balance the collection's demography. To preserve the collection for the future, in 1967, Dr. Trotter contacted T. Dale Stewart to transfer the collection to the Smithsonian Institution. This transaction was completed in 1968.

Currently, a history and exhaustive database are being constructed with dissemination planned in 1999.

A postural model to explain reduced hip extension in Hadar hominid AL 288-1. J.H. HUNT, Anthropology, Yale University, New Haven, CT 06520 and D. SCHMITT, Biological Anthropology and Anatomy, Duke University 27707

At the end of the stance phase in a human stride the femur is maximally extended so that a propulsive force is transmitted through the femoral head and is borne by the anterior bar of the acetabular lunate surface. The acetabulum of AL 288-1 has been reported to have a defective anterior horn of the lunate surface and other bony features surrounding the acetabulum indicate that Lucy did not regularly extend her hips. In humans, increased hip extension has been shown to be a function of increased speed and to be restricted by the iliofemoral ligament. AL 288-1 must have required some speed in her bipedal travel but displays no rugosity for this ligamentous attachment. This study asks, in the absence of an anatomical mechanism, what might have naturally prevented AL 288-1 from extending fully at the hip during a bipedal gait?

An anteriorly-pitched trunk postural model suggests that as a striding biped bends forward at the hips during travel, hip extension should be reduced. Further, because forward pitch of the trunk should displace the center of mass anteriorly, the lower limbs should undergo enhanced protraction during striding. Therefore, increased hip flexion and knee flexion are expected. This increase in yield at the knee is expected to increase support phase duration.

To test the model, ten humans were videotaped in lateral projection while moving bipedally down a 100 foot runway in three trials each of six trunk postures. Trunk, thigh and knee angles were measured for each subject at heel strike, mid-support, toe off and mid-swing. Support phase duration and distance traveled per stride were also measured.

The predictions of the model are supported by the kinematic data. Anterior trunk pitch significantly inhibits hip extension. Subjects bending forward at the hips show significantly increased hip and knee flexion and significantly increased support phase duration.

When humans lean forward at the hips while walking and running, hip extension is significantly reduced without reducing the lower limb's angle of excursion. In the absence of an anatomical restraint, a forward-leaning trunk posture could have imposed a reduced range of hip extension in AL 288-1.

A partly habituated community of dry-habitat chimpanzees in the Semliki Valley Wildlife Reserve, Uganda. K.D. HUNT¹, A.J.M. CLEMINSON¹, J. LATHAM², R.I. WEISS³ and S. GRIMMOND¹

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Fossil assemblages associated with early hominids suggest a habitat that is a mosaic of gallery forest interdigitated with or near drier woodland and savanna biomes. Although there are over a dozen habituated communities of chimpanzees, none is in a habitat closely similar to that of early fossil hominids.

The 548 km² Semliki Valley Wildlife Reserve is located in the western Great Rift Valley, Uganda. The reserve is bounded by the Ruwenzori Mountains to the south, Lake Albert to the north, the Semliki River to the west, and the rim of the rift escarpment to the east. The habitat is predominantly *Combretum* and *Borassus* palm savanna. Habituation efforts have focused on chimpanzees living in riverine forests along the banks of the Mugiri River and its tributaries. Mugiri gallery forests are interdigitated with savanna and open woodland. Dominant tree species are *Celtis africana*, *C. intergrifolia*, *C. mildbraedii*, *C. brownii*, *Albizia grandibracteata*, *A. conaria*, *Chrysophyllum* spp., *Cynometra alexandri*, *Phoenix reclinata*, *Beilschmiedia ugandensis*, *Polyscias fulva*, and *Cola gigantea*.

Semliki is drier than other active chimpanzee research sites. Rainfall was 1411 mm (9/1/97-8/31/98), compared to 1714 mm at Gombe, 1570 mm at Kibale, 1842 mm at Budongo and 1762 mm at Mahale. Rainfall at Mt. Assirik was much lower, 954 mm. The mean minimum daily temperature was 19.6±1.4°C; maximum was 33.9±3.0 °C. Relative humidity daily maxima were 95.2±5.5% wet season and 91.76±4.8% dry season.

Habituation of the Mugiri community began in July 1996. As of 9/1/98 our team had encountered chimpanzees 325 days. Of these, 191 instances were visual sightings, 77 were vocalizations only and on 57 occasions we approached chimpanzees closely by following same-day knuckle/footprints, but did not see them. Sightings increased from 6 days per month in the first half-year to 11 per month for 1/1/98-6/31/98. Minutes of observation increased from 107 in the first half-year to 288 in the fourth and most recent half-year. We have followed chimpanzees to their night nests 5 times and have unnnested individuals 7 times. Twenty-one individuals were counted once, suggesting a community of >40.

Direct observation and dung analysis suggest a severely limited food list; only 16 items have been observed to date.

We have seen no snare injuries, and ear bites, facial scars, missing digits and other healed wounds are notably absent. One recognized old male has whole ears and all 20 digits.

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Taphonomy or Treponematosis?: Distinguishing pathological change from postmortem alteration. S.A. HURLBUT and G.E. BERG, Archaeological Consulting Services, Ltd., Tempe, AZ 85282

Cranial fragments from two individuals recovered from the Globe Highlands of central Arizona exhibit extensive postmortem damage as well as a pattern of pathological

change. Poor preservation and taphonomic factors render identification of pathological conditions difficult, but a diagnosis of possible treponematosi is suggested by close examination.

Within the American Southwest, most cases of treponematosi are dated after A.D. 1100 (Stodder, 1998). No confirmed cases exist for the Globe Highlands or surrounding areas. The individuals described herein were recovered from the multi-component AZ V:9:325/907 (ASM/TNF) site and were interred through a pithouse floor. The structure yielded an archaeomagnetic date of A.D. 675-775; interment style and accompanying artifacts are consistent with this date.

Both individuals exhibit cranial lesions, including areas that resemble active bone resorption and radial scarring described in Hackett (1976). Postcranial remains appear nonpathological, with no evidence of lesions. Differential diagnosis rules out other conditions such as osteosarcoma, tuberculosis, and trauma. Localized scalp infection is a possibility, although the lesions lack the well-defined margins which characterize circumscribed pathologies.

Taphonomic changes to these individuals include root action, rodent gnawing, cortical erosion, and breakage. Growth of roots around and through the crania resulted in surficial damage as well as holes penetrating the bone. Rodent gnawing is easily distinguished by the presence of paired grooves, which may be concentrated on the borders of pathological lesions. Cortical erosion and postmortem fracture have resulted in the loss of some bone surfaces.

It is argued that these individuals exhibit both taphonomic and pathological change. Taphonomic overprinting obscures the original bone condition, making paleopathological diagnosis difficult. Further, a pathological condition may have made the bone more susceptible to taphonomic processes, leading to destruction and alteration of the bone. The pathological changes present are most consistent with possible treponematosi.

Maize, Midden, and Mollusc: Interpreting Subadult Diet and Pathology in Late Woodland coastal North Carolina. D. L. HUTCHINSON, East Carolina University, Greenville, NC 27858, and L. NORR, University of Florida, Gainesville, FL 32611

The weaning diet in many areas of the world is comprised of starchy gruels. It is not uncommon that carbohydrates continue to form the major portion of the diet of young children. In the Americas, one of the major sources of carbohydrates in the past and the present is maize. Often associated with a diet focused on maize are an increase in dental and skeletal pathological lesions, such as carious lesions and porotic hyperostosis.

We report in this paper on two Late Woodland populations (A.D. 1200-1550) from the North Carolina coastal plain. The population interred at Hollowell is on the border of the interior estuary Iroquoian linguistic group who are a late arrival into the region from elsewhere, and apparently brought in a tradition of maize agriculture. The population interred at Baum is in the

outer coastal geographic range of the Algonkian language group. Both groups exhibit lesion frequencies for porotic hyperostosis and dental caries that have been attributed for other groups to a diet focused on maize.

We compare the frequencies of pathological lesions in these two populations in order to examine differences in the reliance on maize during the subadult and adult years. Dietary reconstruction using stable isotopes of carbon and nitrogen serves as the method of interpreting diet. Although an increased emphasis on maize agriculture in late prehistory has been offered as one explanation for the pathologies in the outer coastal populations, we explore other possible explanations for the pathologies such as parasite ingestion and dental damage.

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Comparative ontogenetic morphology of the hand among subspecies of *Gorilla* and species of *Pan*. S. E. INOUE, Ohio University, Athens, OH 45701.

Differences between *Pan* and *Gorilla* in the morphology of the hand related to locomotion and manipulative capabilities are well documented. However, we know much less about variation in hand morphology within each genus. Therefore, I quantified some skeletal features of that describe general and articular dimensions of the metacarpals and phalanges in an ontogenetic series of *Pan paniscus*, *Pan troglodytes*, *Gorilla gorilla gorilla* and *Gorilla gorilla beringei*. I then compared the results of the interspecific analyses of *Pan* to the intersubspecific analyses of *Gorilla*.

I ran principal components analyses (PCA) on the suite of metacarpal and phalangeal variables separately. From these PCAs, I found that the first component (PC 1) of both PCAs accounts for most of the variation and distributes the subspecies and species of African apes according to overall size. For the PCA on the metacarpals, the second component (PC 2) clearly separates all of the taxa such that there is a downward transposition in data scatters going from *P. paniscus*, *P. troglodytes*, *G. g. gorilla*, to *G. g. beringei*. For the PCA on the phalanges, PC 2 separates *P. paniscus* from *P. troglodytes*, but does not distinguish *G. g. gorilla* from *G. g. beringei*. These results were confirmed with further PCAs and ANCOVAs done separately for each genus. Examination of the variables that load most strongly indicate that for both *Pan* and *Gorilla*, the variables that drive the separation of species and subspecies on PC 2 are metacarpal midshaft diameters. However, unlike the results from the *Pan* PCAs, metacarpal lengths also help to drive the separation between subspecies in the *Gorilla* PCAs. Characters from the first proximal phalanx appear to drive the separation between the species of *Pan* on PC 2.

The morphological variation in the hand between *Pan* and *Gorilla* approximates the degree of difference found between species/subspecies within each genus. These interspecific and intersubspecific differences, like the differences

between the genera, may be related to differences in locomotion among these taxa.

This research was made possible by support from NSF (BNS-9000964) and Northwestern University (0100-510-152Y).

The Iberomaurusians: Ancestors to subsequent North African peoples or a genetic dead-end? J.D. IRISH, Department of Anthropology, University of Alaska Fairbanks, Fairbanks, AK 99775-7720.

Data obtained during ongoing diachronic dental study of African populations address two questions that have been sources of bioarchaeological contention for 30+ years. First, is there continuity between Late Upper Pleistocene Iberomaurusians and later Northwest Africans (Capsians, Berbers, Guanche)? And second, were Iberomaurusians and Northeast African "Mechoitoid" Nubians variants of the same population?

Regarding the first question, some workers (e.g., Balout, 1955; Camps, 1974; Chamlal, 1978) believe gracile, Early Holocene Capsians replaced skeletally-robust Iberomaurusians. The Capsians then, who may have migrated in from the east, are precursors to later native Northwest Africans. However, other research (e.g., Lubell et al, 1984) suggests continuity from Iberomaurusian through Capsian times, and beyond.

It has also been maintained that Iberomaurusians show a close affiliation with Late Paleolithic Nubians (e.g., Anderson, 1968; Clark, 1970; Greene and Armelagos, 1972). Both groups shared similar tool kits and burial practices, as well as skeletal features. Yet, Bermudez de Castro's (1991) comparative dental study proved inconclusive. And, recent craniofacial (Franciscus, 1995) and post-cranial (Holliday, 1995) analyses cast doubts on such an affinity.

In the present study, Iberomaurusians (15,750-10,500 BP) from Taforalt (n=42) and Afalou (n=48), Nubians (14,500-12,500 BC) from Jebel Sahaba (n=67), and Capsians (8,500-5,000 BP) from Algeria and Tunisia (n=24), were compared using Konigsberg's (1990) Mahalanobis distance statistic on 36 discrete dental traits. They were then compared to 27 other North (n=637) and sub-Saharan (n=825) African samples to help estimate local and regional affinities.

Results revealed (1) a close relationship among the Iberomaurusian and Capsian, as well as later Maghreb samples -- particularly Berbers, and (2) a divergence among the Iberomaurusian and early Nubian samples. Thus, long-term population continuity in the Maghreb is supported, while greater North African population heterogeneity during the Late Pleistocene is implied.

Supported by grants from the NSF (BNS-9013942), Arizona State Univ. Research Development Program, and American Museum of Natural History.

The evolution of human skin pigmentation. N.G. JABLONSKI and G. CHAPLIN, Department of Anthropology, California Academy of Sciences, San Francisco, CA 94118-4599.

Skin color is one of the most conspicuous ways in which humans vary. Here we present evidence indicating that variation

in skin color is adaptive, and that it is related to the regulation of ultraviolet light, especially ultraviolet B (UVB), penetration in the integument and its direct and indirect effects on fitness. Apart from its role in vitamin D synthesis, the effects of UVB radiation on the skin are harmful and mutagenic. Which of these effects have had sufficient impact on individual fitness so as to bring about adaptive changes in integumentary coloration? UV-induced skin cancers generally occur later in life and rarely affect reproductive success. It is argued here that, under conditions of high UVB intensity throughout most of the year, highly melanized skins have evolved to protect against UV-induced photolysis of folate, a metabolite essential for the normal development of the embryonic neural tube and spermatogenesis. Through folate's roles in the normalization of neurulation and maintenance of male fertility, regulation of folate levels would appear to be critical to individual reproductive success. This has been accomplished in human evolution by regulation of dietary intake of folic acid and the control of UV-induced folate photolysis. The latter was accomplished by increasing the concentration of the natural sunscreen, melanin, in the skin. Dark pigmentation also prevents UVB-induced injury to sweat glands, which are required for thermoregulation.

Outside of the tropics, more lightly melanized skins have evolved to permit UVB-induced synthesis of previtamin D₃ in the skin, a compound which is later thermally converted to vitamin D₃.

When all published sources of information on the skin color of indigenous peoples are analyzed and mapped, the clinal gradations of skin color observed are found to be correlated with UVB levels and represent a compromise solution to the conflicting physiological requirements of photoprotection and vitamin D synthesis. In the extreme Northern and Southern Hemispheres, where there is not sufficient UVB to produce adequate previtamin D₃ in human skin over the course of a year, human habitation has depended upon the evolution of diets that are high in vitamin D.

It is concluded that skin color is an adaptive feature of the human phenotype that has no significance in the determination of phylogenetic relationships between human populations.

Interspecific dental allometry in strepsirrhine primates. T.R. JACKSON, Whitney Young High School and Chicago Academy of Sciences, Chicago, IL. 60611 and C.J. VINYARD, CM Biology, Northwestern University and Chicago Academy of Sciences, Chicago, IL. 60611.

The interspecific allometry of primate molar dimensions attracts widespread interest in primatology. Researchers often functionally and/or adaptively link molar scaling across species to metabolism, diet and occlusal force. In addition, regressions of body mass against molar dimensions in living primates are often used to infer body mass in fossil taxa. While several previous investigations include strepsirrhines, no study of molar scaling has analyzed a relatively complete strepsirrhine sample. Further, most previous efforts estimate molar areas by multiplying molar length*width rather than attempting a more accurate measure of molar areas.

Buccolingual widths, mesiodistal lengths and molar areas - computed from tooth outlines - were measured in 41 extant and 9 subfossil strepsirrhine taxa from video using JAVA software. Cranial scalars were taken with calipers and body mass values were acquired from published sources. Least-squares (LS) and reduced-major axis (RMA) regressions were performed on species means of molar dimensions versus body mass and skull size estimates.

Strepsirrhine regressions of \ln molar area (the sum of M¹-

M² areas) versus \ln body mass indicate that molar area scales near isometry (0.66) for both LS (0.584) and RMA (0.679) methods. The RMA slope overlaps the predicted 0.75 metabolic scaling coefficient suggesting that molar areas may be tracking metabolic demands. Similar slopes are apparent in regressions of each molar tooth versus body mass and skull size. LS regressions of \ln M¹ length*width (0.610) and \ln M¹ area (0.608) versus \ln body mass yield similar slopes justifying prior estimates of molar area.

To assess the influence of diet and phylogeny on molar scaling, species were separated by diet (i.e. folivore, frugivore, insectivore) and taxonomy (i.e. families). Separate regressions for each category were compared via ANCOVA. No significant differences are seen in regressions of molar dimensions across both diet and phylogeny suggesting these factors have limited impact on molar scaling in strepsirrhines.

This study was supported by program funding from the Howard Hughes Institute, Peoples Gas Corporation and YouthAlive as well as research grants from NSF (SBR-9701425), Leakey Foundation and AMNH.

Analysis of a standard for use in scoring of anemia. K.P. JACOBI, Department of Anthropology, University of Alabama, Tuscaloosa, AL 35487-0340, and M.E. DANFORTH, Department of Anthropology and Sociology, University of Southern Mississippi, Hattiesburg, MS 39406-5074.

Specimens for the scoring test came from three Alabama prehistoric sites. Novice to experienced scorers were given, for reference, copies of photos and explanation of porotic hyperostosis and cribra orbitalia scoring from the standards reported in Buikstra and Ubelaker (1994). The test evaluated 21 scorers for interobserver error on four factors: presence of pathology, appearance of the porosity, degree of healing, and level of confidence.

Participants showed good levels of agreement (>80%) when a lesion was considered present, but most scorers never agreed that a specimen was free of pathology. Greater variation was seen in evaluation of porosity size among those cranial fragments with anemia. Only four skulls had >90% agreement and displayed either extremely mild or severe expressions of anemia. Determination of degree of healing showed even more diversity among participants with 19 of 21 skulls each having all three scoring selections given. This last variable was the only one in which level of experience made a difference.

These findings suggest that further study is necessary to produce scoring standards for porotic hyperostosis and cribra orbitalia that are effective and reliable.

Age and perceived stress independently influence daily blood pressure variation among women employed in wage jobs. G.D. JAMES, Binghamton University-SUNY, NY 13902 and D.H. BOVBERG, Mt. Sinai School of Med., NY 10029.

Previous studies show that the pattern of daily blood pressure variation among urban, pre-menopausal women employed in clerical or technical jobs is influenced by the perceived stressfulness of diurnally changing micro-environments. The purpose of this study was to examine whether age modified this relationship. The subjects of this study were 91 women (age=33.8±8.5; range 18.2 to 49.3 years) who wore an ambulatory blood pressure monitor over the course of one workday. Blood pressure (BP) averages were calculated at work (W)(11AM-3PM), home (H)(6PM to approx. 10PM) and during sleep (S)(approx. 10PM to 6AM). The stressfulness of W and H was rated on a scale of 0 (low) to 10 (high). Analysis of covariance was used to assess the cross-classified effects of perceived stress (W-stressed (W>H stress; N=41), H-stressed (H>W stress; N=39) and equally-stressed (W=H stress; N=11)) and age group (18.0-29.9, N=31; 30-39.9, N=34; 40-49.9, N=26) on the blood pressure measures with body size and fat and menstrual phase as covariates. W-stressed women had higher systolic BP at W, H and during S than H-stressed women (127 vs 120, p<.009; 124 vs 119, p<.05 and 111 vs 102, p<.006). Equally-stressed women had higher W (123) and H (123) systolic BP than H-stressed women, but less than W-stressed women. Similar patterns were found with diastolic BP. Age showed a "U" shaped relationship, with women in the 30-39.9 age range having lower systolic and diastolic BP at W, H and during S than their younger and older counterparts (p<.05 except S systolic BP). The interactive effect between age group and perceived stress level was not significant, so that the variation in BP associated with perceived stress (W-stressed, H-stressed, equally stressed) was similar in each age group. These data suggest that while the level of BP changes with age, environment related stress continues to have a significant effect on daily BP variation. Of additional interest, however, is the fact that these data also show that BP measured during the day in working women may not necessarily have a direct, positive association with age.

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Infant diseases in Eastern Europe during the Late Middle Ages and Early Modern Times. - R. JANKAUSKAS, Department of Anatomy, Histology and Anthropology, University of Vilnius (Lithuania) and M. SCHULTZ, Center of Anatomy, University of Göttingen (Germany).

Up to now, little is known about the etiology and epidemiology of infant diseases in Eastern Europe during the Middle Ages and Early Modern Times. The skeletons (n=1152) excavated at the cemetery of the Lithuanian town of Alytus which date back to these time periods (14th-17th century AD) and constitute a reliable example were examined by macroscopic, radiological, endoscopic, light- and scanning-electron microscopic techniques. For this

study, 146 infant skeletons selected at random were available: infants Ia (n=64), infants Ib (n=40), and infants II (n=42) individuals.

There is strong evidence of malnutrition such as scurvy, rickets, and anemia, whereby anemia was very probably not only caused by dietary deficiency. The frequencies of inflammatory diseases are striking. In almost 80% of all skulls investigated vestiges of meningeal reactions were diagnosed (e.g. hemorrhagic-inflammatory meningitis). Very frequently, the lesions are expressed as hemorrhagic-inflammatory changes of the venous sinuses of the meninges (e.g. perisinuous processes). There are also significant vestiges of leptomenigitis tuberculosa (16%). Osteomyelitis and periostitis were relatively rare, while the frequencies of inflammatory processes of the middle ear region and the paranasal sinuses are relatively high. In summary, the scope and the frequencies of diseases characterize the population from Alytus as typical urban who probably lived at a relatively low social level.

The research was supported by the Deutscher Akademischer Austauschdienst, the University of Göttingen and the Deutsche Forschungsgemeinschaft.

Human fetal cranial base flexion and brain volumes: a high resolution Magnetic Resonance Imaging (hrMRI) study. N. JEFFERY and F. SPOOR, Evolutionary Anatomy Unit, Dept. Anatomy and Developmental Biology, University College London, WC1E 6JJ, UK.

Interspecific comparisons between adult non-human primates have revealed a correlation between the degree of basicranial flexion and brain volume relative to basicranial length (Ross and Ravosa, 1993; Spoor 1997). This observation is seen as a corroboration of the hypothesis that the marked basicranial flexion in modern humans results from a phylogenetic increase of relative brain size. In an attempt to study the ontogenetic mechanism underlying this relationship human fetal development of the brain and cranial base was investigated.

Forty formalin preserved human fetuses, 53-205mm crown rump length (11-24 \pm 1 weeks gestation), were imaged using hrMRI. Transverse T2 weighted images were acquired contiguously through the head, interpolated in the slice direction and then resampled into sagittal slices. Resolutions and slice thickness' obtained were 156-312 μ m and 312-624 μ m respectively. Four fetuses were excluded on the basis of deformities shown in the images. Endocranial volumes were estimated as the sum of pixel areas multiplied by the slice thickness. Coordinates for three landmarks, foramen caecum, sella and basion were taken in midline images and used to calculate cranial base lengths and cranial base angles. Relative brain size was calculated as the cube root of brain volume divided by base length.

Absolute brain size increases 47 fold (1.87-87.44cm³) over the period studied, and the increase of relative size is statistically significant, but rather small (cube root brain volume vs. cranial base length: r_s

=0.9750 [$P < 0.001$]; RMA slope =1.160 [1.087-1.233, 95% conf. int.]; n=36). However, this increase of relative brain size is not significantly correlated with cranial base angle ($r_s = 0.0824$ [$P > 0.05$]). These results fail to support the notion of brain growth directly and mechanically driving the degree of basicranial flexion during human development, at least during the period studied.

Distribution of HIV-1 resistant polymorphisms (CCR5- Δ 32, SDF1-3'A and CCR2-64I) in East Asia and world populations and its implication in AIDS epidemiology. LI JIN, BING SU, RANAJIT CHAKRABORTY, Human Genetics Center, University of Texas School of Public Health, Houston, TX 77225.

Chemokine receptors CCR5, CCR2 and stromal-derived factor (SDF-1), a ligand for chemokine receptor CXCR4, are involved in HIV infection and AIDS symptom onset. Recent cohort studies show that point mutations in these three genes, CCR5- Δ 32, CCR2-64I and SDF1-3'A, can delay the onset of AIDS up to 16 years or more after seroconversion. The protective effects of CCR5- Δ 32 and CCR2-64I are dominant while that of SDF1-3'A is recessive. SDF1-3'A homozygotes also show potential protections against HIV-1 infection. In this study, we surveyed the frequency distributions of the aforementioned three alleles at these loci in world populations with an emphasis on those in East Asia. The CCR5- Δ 32 allele is virtually absent in non-Caucasian populations. The frequencies of CCR2-64I do not vary significantly among different continents, ranging from 0.1-0.2 in most populations. However, a decreasing cline of this allele frequency from north to south was observed in East Asia. Contrasting the distribution of CCR2-64I, the distribution of SDF1-3'A in the world populations is much more uneven, with the highest frequency observed in Oceanian populations. An increasing cline of the SDF1-3'A frequency from north to south was observed in East Asia. The relative hazard (RH) values were computed to evaluate the AIDS onset risk based on the three-locus genotype frequencies in the East Asia and world populations, which appear to have a direct implication in AIDS epidemiology with regard to the foci of global occurrences AIDS. (Research supported by the US Public Health Service research grant GM 41399).

Ecological aspects of locomotion: modern hominoids across continents. K.B. JOHNSON, Department of Anthropology, Southern Illinois University, Carbondale, IL 62901.

Although all modern hominoids share suspensory adaptations of the shoulder and upper limb, it is well known that the African apes are mostly terrestrial, while the Asian apes are highly arboreal. Why did African and Asian

apes follow these two very different evolutionary paths? In an effort to answer this question, several ecological variables were compared between field sites at which apes have been studied, including six African sites (Lope, Gabon; Wamba, Zaire; Bai Hokou, Central African Republic; Karisoke, Rwanda; Mahale, Tanzania; and Kibale, Uganda) and three Asian localities (Kutai and Tanjung Puting, Borneo and Ketambe Sumatra). For each site, ecological variables taken from literature include habitat structure, climate, total number of primate species at the site, and the body size and dietary adaptations all primate species within the community.

Differences between habitat structure and the number and body size of other primate species in African and Asian hominoid study sites were most apparent. All of the Asian sites are primary dipterocarp forest, and two of the three are characterized as swamp. Terrestrial travel through the swampy understory is difficult (Galdikas, 1995). The African study sites varied tremendously in habitat structure, ranging from primary rainforest to open grassland for *Pan troglodytes* and mountain meadows for *Gorilla g. beringei*. In Asia, there are remarkably few primate species that coexist with *Pongo* and all of them are small bodied. In Africa, both the number of species coexisting with the apes, and the body size of these primates, were larger. Differences in the seasonality of fruiting trees was also found between African and Asian hominoid sites. Fruiting seasons tend to be more punctuated in African than in Asian habitats.

While no definitive conclusions are reached, this study does suggest that habitat structure may have responsible for keeping Asian apes in the trees. Semi-terrestrial locomotion allows the African apes to exploit the highly diverse habitats in which they are found.

Hopewellian culturally modified human remains. C.A. JOHNSTON, P.W. SCIULLI and L.A. MILLS, The Ohio State University, Columbus, Ohio 43210

Among the sometimes exotic raw materials used by Middle Woodland Hopewellian people for artifact manufacture is human bone. Modified human skeletal elements are more common in Middle Woodland sites than in any other Midwestern cultural horizon. Modifications include grinding, breakage, drilling, polishing, notching and cutting and modified elements come from a variety of burial contexts within burial mounds attributable to Hopewell. Both cranial and postcranial elements are represented, however perforated crania and heavily ground mandibles and maxillae are most numerous and possibly hold the most information about the biological nature of the individual from whom the bone was obtained.

The focus of this paper is age at death and sex of the individual, as well as biological relationship to non-modified representatives of the burial population. Skeletal material from five Ohio Hopewell sites is used in this study. Age at death is assessed via seriations of maxillary and mandibular dental attrition. Sex is estimated using seriations of cranial and mandibular sex indicators. Discriminant function analyses of cranial and mandibular metrics are employed to assess size and shape similarity of individuals represented by modified remains to unmodified individuals from Hopewell contexts. The applicability of these data to hypotheses regarding the cultural significance of Hopewellian modified human remains will be discussed.

Testicular size, social behavior, and ontogeny in wild baboons. C.J. JOLLY, Anthropology, New York University, New York, NY, 10003 and J.E. PHILLIPS-CONROY, Anthropology, Washington University, St Louis, MO, 63110

Testicular size in mammals is considered a correlate of physiological investment in sperm production, and relatively larger testes are seen in species whose social behavior is conducive to sperm competition. Such behavior is much more frequent among anubis baboons (*Papio hamadryas anubis*) than among hamadryas (*P. h. hamadryas*). In our sample of 244 wild-caught animals, fully adult hamadryas have testes about 50% smaller than those of anubis of comparable age. Underlying this difference are divergent ontogenetic patterns that are not obviously predicted by the sperm competition model, but are compatible with the derived life-history and reproductive behavior of male hamadryas and contribute to the suite of related behavioral, anatomical and physiological adaptations distinguishing this subspecies. The baboon analogy suggests that effective monandry, not necessarily associated with monogyny or "pair bonding", characterized the pre-cultural ancestry of *Homo sapiens* after divergence from its common ancestry with *Pan*. Supported by the National Science Foundation, the National Institutes of Health, The Harry Frank Guggenheim Foundation, and Earthwatch.

Brain size and body size in subfossil Malagasy lemurs.
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Brook, NY 11794-8081.

Descriptive research on the surface anatomy of brain endocasts taken from the crania of giant extinct lemurs began over a century ago (Major, 1897). Although "allometry" is said to affect the gross brain morphology of these subfossil lemurs (e.g., Radinsky, 1979), there are few published data on cranial capacities and no detailed analyses of brain size scaling that include these taxa. This report presents new data on the cranial capacities of all known genera of subfossil lemurs (except *Daubentonia robusta*) and places this information into a comparative framework of relative brain size and scaling in extant primates and other mammals.

Using mustard seed and graduated cylinders, cranial capacities were measured (rounded to the nearest 1.0 cc) for the following species: *Megaladapis edwardsi*, *M. grandidieri*, *M. madagascariensis*, *Pachylemur insignis*, *P. jullyi*, *Mesopropithecus globiceps*, *M. pithecoides*, *Babakotia radofilai*, *Palaeopropithecus maximus*, *Hadropithecus stenognathus*, *Archaeolemur edwardsi*, and *A. majori*. Average values range from 40 cc (*M. pithecoides*) to over 130 cc (*M. edwardsi*). Although some matrix remains within the brain case of the only known skull of *Archaeoindris fontoynontii*, its cranial capacity was greater than 200 cc (and is estimated conservatively here as 225 cc). Body mass estimates for subfossil lemurs derive from humeral and femoral circumference regressions developed by Godfrey et al. (1995). Brain size and body size data for living taxa are taken from museum specimens and the literature.

Bootstrapped comparisons confirm that haplorhine primates have larger brains at any given body size than do living strepsirhine primates. This difference is exaggerated by the addition of subfossil lemurs, and brain size scaling for all strepsirhines is strongly negatively allometric (e.g., 95% confidence intervals for the slope do not even include 0.67). Narrow allometric contrasts are also instructive: e.g., the cranial capacity of *P. maximus* was roughly 25% of that of comparably sized chimpanzees; the cranial capacity of *M. madagascariensis* was about 20% of that seen in female orang-utans. Nevertheless, the brain sizes of all subfossil lemurs fall well above the line characterizing living mammals.

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Intestinal parasite infections in two groups of mantled howling monkeys (*Alouatta palliata*) on the island of Ometepe, Nicaragua.
J.A. KAHRE, Whitman College

Understanding the dynamics of parasite transmission and infection in wild primate populations has become increasingly important in planning conservation efforts due to the potential of parasites as vectors for disease. Not only are parasitic infections influenced by social interactions and behavior of the host species, but they are also affected by several environmental factors including quality of habitat and human activity (Scott, 1988;

Stuart, et. al, 1990; Grier and Burk, 1992; Stoner, 1996). This study compares the prevalence and mean intensity of the intestinal parasite infections in two troops of mantled howling monkeys (*Alouatta palliata*) living in fragmented habitats of dry tropical forest on the island of Ometepe, Nicaragua.

In July and August of 1998, fecal samples (N=22) were collected from approximately 20 individuals belonging to two focal groups. Group 1 resided in a secondary growth forest which was not being cut or cultivated during the study period. Much of the forest within and around the home range of group 2 had been recently disturbed by human activity (Garber, et al, in prep).

Several types of parasites were identified by the presence of larvae, eggs, and/or adult individuals. All members of *A. palliata* group 1 were infected by one or more species of parasite, and approximately 93% of group 2 were infected. All parasites found in group 1 were also observed in group 2. However, additional species of nematode were found in group 2 which were not seen in group 1. These apparent differences may be due to the greater proximity of group 2 to human settlements, which could result in increased opportunities for cross-species parasite transmission.

The results of this study seem to indicate that prevalence and intensity of intestinal parasite infections in *Alouatta palliata* on the island of Ometepe, Nicaragua may be affected by several factors, including habitat destruction, contact with domestic animals, and other things associated with human presence.

The support provided by the Ometepe Biological Field Station is greatly appreciated.

Cultural and biological relationships between two Late Woodland populations on the North Carolina Coastal Plain. A.M. KAKALIOURAS, University of North Carolina, Chapel Hill, D.L. HUTCHINSON, East Carolina University, Greenville.

Many recent studies of Native American coastal populations of the eastern United States have focused on the biological and cultural impact of two major transitions in lifeway: the intensification of domesticated plants and the arrival of Europeans. Pre-contact migrations of people from elsewhere bringing new cultural traditions and technologies have largely been ignored. This paper explores biological and adaptational relationships between Late Woodland skeletal populations of differing cultural affiliations, in conjunction with new research on the population dynamics of North Carolina coastal groups.

Archaeologists have divided the Coastal Plain into three distinct regions--Algonkian, Iroquoian and Siouan--generally coinciding with linguistic groups present at European contact (Phelps, 1983). Reconstructions of these "local cultures" have usually emphasized the distinct material and social culture that accompanied the linguistic divisions. Although rough morphological comparisons between groups have been observed, no systematic skeletal and dental indicators have been employed in evaluating relationships these populations.

Two Late Woodland skeletal series are considered in this investigation: an interior riverine Iroquoian population

(31Br7/Jordan's Landing, n=52), and an outer coastal Algonkian population (31Ck9/Baum site, n=200). Dental metric and non-metric data illuminate some biological difference between the groups, and caries prevalences and dental health indicates that maize may have been an important dietary constituent to both populations. Prevalence of skeletal pathological conditions (e.g., treponematoses and porotic hyperostosis) is generally greater at the Baum site than at Jordan's Landing. These differences may represent contrasting lifeways and environmental circumstances associated with the respective coastal and terrestrial settings.

Cerebrospinal fluid monoaminergic metabolites differ in wild anubis, hamadryas, and hybrid baboons, possibly reflecting variation in life history. J.R. KAPLAN, Anthropology, Wake Forest University, Winston-Salem, NC 27157; J. E. PHILLIPS-CONROY, Washington University; C. J. JOLLY, New York University, M. B. FONTENOT, Wake Forest University; and J.J. MANN, Columbia University.

Male hamadryas baboons (*Papio hamadryas hamadryas*) rarely leave the social groups into which they are born; in contrast, closely related anubis (*P. h. anubis*) males almost always disperse from their natal groups. Based on the observation that late-emigrating rhesus monkey (*Macaca mulatta*) males have higher cerebrospinal fluid (CSF) concentrations of the serotonin metabolite 5-hydroxyindoleacetic acid (5-HIAA) than do their early-dispersing counterparts, we hypothesized that hamadryas males would have higher CSF 5-HIAA concentrations than would anubis males. We tested this hypothesis with CSF samples taken from animals living in the Awash National Park of Ethiopia. In addition to CSF 5-HIAA, CSF concentrations of the metabolites of dopamine (homovanillic acid [HVA]) and norepinephrine (3-methoxy-4-hydroxyphenylglycol [MHPG]) were assayed in 10 anubis males, 12 anubis-hamadryas males, and 47 hamadryas males. After covarying for body weight (as a surrogate for age), there was a significant (all p 's < 0.05) stepwise (anubis, hybrid, hamadryas) increase in two indices of serotonergic activity (the ratio of CSF 5-HIAA/HVA; residual 5-HIAA after regression against HVA); a third measure, CSF 5-HIAA concentration, was higher in both the hybrids and the hamadryas than in the anubis (p 's < 0.05), with no differences between the hybrids and hamadryas. Although correlations among the metabolites were significant, variation in HVA and MHPG did not parallel that observed with respect to 5-HIAA; HVA and MHPG were lowest in the hamadryas and highest in the hybrids, with the anubis values intermediate (p 's < 0.05). The patterning of these data provide initial evidence that taxonomically relevant differences in dispersal may reflect underlying divergence in central serotonergic activity, apparently unassociated with variation in other monoaminergic systems. Supported in part by SR615150 (JPC, CJJ), MH 46745 (JJM), and HL40962 (JRK).

A computer program for delivering virtual multimedia examinations across secure networks and the web. J. KAPPELMAN¹, A. GORDON¹, D. JOHNSON^{1,2}, T. RYAN¹, R. SCOTT¹, and E. SEIFFERT¹ ¹Dept Anthropology, The University of Texas, Austin, TX 78712-1086, ²Dept Biological Anthropology and Anatomy, Duke University Medical Center, Durham, NC

Recent advances in computer software and hardware now permit instructors to digitize a multitude of teaching and research materials for delivery in the classroom and laboratory. Although many presentation programs are available, no fully integrated multimedia exam programs exist. Many instructors are now in the unfortunate position of being unable to test their students over the exact materials that they are taught.

We have developed an easy-to-use dual platform computer program that now permits instructors to deliver truly interactive virtual multimedia exams and quizzes. The content of each exam is drawn from the full range of multimedia materials that an instructor uses and can include 2-D color and black and white images or plots, sound clips, video clips, and 3-D animations. The multimedia materials can be integrated with multiple choice, matching, true/false, plotting, fill-in, and interactive questions.

In order to use the program, the instructor saves the desired media in commonly used formats. Questions are saved in a simple text file format, and this simplicity permits the instructor to "cut and paste" questions from previous exams. These materials are next imported into the program and linked to one another within the exam framework. The exam itself can mirror common hardcopy exams in presenting a fixed number of questions or function interactively. The interactive exam can be designed to randomly or expertly select from among various categories of questions to produce a unique but uniform exam for each student. Answers require the student to respond with a keyboard entry or "drag and place" mouse-driven operations. The grade is calculated automatically and reported to the student immediately upon completion of the exam.

Potential users can visit the web site "<http://www.dla.utexas.edu/depts/anthro/kappelman/vexams/vexam.html>" for additional information, and are encouraged to bring their multimedia materials to the AAPA meeting so that they can test the virtual multimedia exam program for themselves.

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Y chromosome polymorphisms in Chinese ethnic populations. T. M. KARAFET, University of Arizona, Tucson, AZ 85721, and Institute of Cytology and Genetics, Novosibirsk, 630090, Russia, L. P. XU, R. F. DU, Institute of Genetics, Chinese Academy of Sciences, Beijing 100101, P.R. China, W. WANG, City University of Hong Kong Kowloon, Hong Kong, S. FENG, Nankai University, Tianjin, P.R. China, and M. F. HAMMER, University of Arizona, Tucson, AZ 85721.

We used 15 Y chromosome markers to study affinities among 13 ethnic groups in China and their paternal relationships to other world populations.

The polymorphisms surveyed included 12 biallelic and three microsatellites. Our Chinese sample consisted of 706 males from two Han and 12 ethnic minority subpopulations.

The combination of variation at the biallelic polymorphic sites resulted in eight Y-haplotypes which were unevenly distributed among the populations in China. YAP+ chromosomes were present in six populations with the highest frequency in Tibet (49.3%). Consistent with previous findings in northern Asia, all Y chromosomes carrying the YAP element in Chinese populations belong to haplotype 3G, the most ancestral YAP+ lineage. We found that four populations (Uygurs, Huis, Evenks and Oroqens) were very different from the other Chinese populations due to the rather high frequencies of Y-haplotypes typically found in Central Asian and/or in East Siberian populations. Among the southern Chinese populations surveyed, the Zhuang and Guangdong Han consistently grouped together in phylogenetic trees based on both Y-chromosome haplotypes and classical markers.

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Phylogenetic relationships of the Kromdraai hominid sample. K.A. KASZYCKA, Institute of Anthropology, Adam Mickiewicz University, Poznań, Poland.

Several authors have used the cladistic approach to discuss hominid phylogeny, the only study, however, using this approach which considers the Kromdraai and Swartkrans samples as separate taxonomic units was an analysis done by Grine (1984, 1985). Phylogenetic systematic methods were applied here in order to determine the common ancestry relationships among early hominid taxa, and in an attempt to infer hypotheses about their ancestor-descendant relationships. The aim of this study was to answer a question: What role (if any) does Kromdraai play in the origin of the other "robust" australopithecines, and/or early *Homo*?

The cranial, mandibular and dental remains of the 13 Kromdraai individuals known to date were analysed. The data include both metrical and non-metrical features. Several hundred early hominid specimens belonging to four other samples/taxa have been studied for purposes of comparison. These are: (1) Swartkrans Member 1, (2) *A. africanus*, (3) *A. boisei*, and (4) early *Homo*. Out of 94 characters used, the Kromdraai sample displays: 28 shared primitive, 64 shared derived, and 2 unique derived characters.

Phylogenetic analyses were performed by PAUP, a computerized cladistic program (Phylogenetic Analysis Using Parsimony), version 3.1.1 (Swofford 1993). Two equally parsimonious cladograms were obtained (Tree length = 160, CI = 0.83). Cladistic analysis has revealed: (A) Kromdraai is most closely related to Swartkrans; (B) Kromdraai is a sister group of the Swartkrans and *A. boisei* clade.

The following conclusions have been reached: (1) Kromdraai is the most closely related to Swartkrans, being possibly an earlier, ancestral, and more plesiomorphic

representative of the same species, i.e., *A. robustus*. (2) At the same time, Kromdraai appears to be the most suitable known ancestor to *A. boisei* as well. (3) It is possible that Kromdraai, being the ancestral species, did not lose its identity and evolutionary direction, and can therefore be said to have survived the split of *A. boisei*, lasting as the same species, i.e., *A. robustus*, as represented by the Swartkrans sample. (4) The significance of the Kromdraai sample lies, therefore, in its role as a plausible ancestor of the "robust" australopithecine clade.

A re-examination of factors contributing to elevated stable nitrogen isotope values in infants and young children. M.A. KATZENBERG, Department of Archaeology, University of Calgary, Calgary, AB T2N 1N4.

One method of monitoring infant and early childhood diet in past populations is the analysis of stable isotopes of nitrogen in preserved bone collagen. The method is based on the fact that nitrogen isotopes reflect diet and trophic level, and that while babies are nursing, their nitrogen isotope ratios are elevated relative to those of their mothers, and other adults in the population. Because the bones that are analysed are from infants and young children who died, it is important to be aware of other factors that may lead to elevated nitrogen isotope ratios. These factors include negative nitrogen balance, which occurs with protein insufficiency.

Nitrogen isotope data from large historic skeletal samples is re-examined in light of possible causes of death. While the method as originally proposed is valid, it is necessary to recognize the role of negative nitrogen balance in causing the reutilization of existing protein, and the consequent increase in stable nitrogen isotope ratios which may result in the rapidly deposited bone of growing infants and children.

Familial risk of high blood pressure in Canada. PT KATZMARZYK^{1,2}, T RANKINEN², L PÉRUSSE², DC RAO³, and C BOUCHARD², ¹York University, Toronto, ON, ²Laval University, Ste-Foy, QC, ³Washington University School of Medicine, St. Louis, MO.

The familial risk for a trait can be estimated using the lambda coefficient (λ_R), which is defined as the ratio of the prevalence among relatives of a proband of degree R to the general population prevalence of a trait. The purpose of this study was to estimate the familial risk of high blood pressure (BP) in a representative sample of the Canadian population. To this end, data from the Canada Fitness Survey of 1981 were used. The sample consisted of

14,547 participants distributed among 5,122 nuclear families for whom measurements of resting blood pressure and heart rate were available. Variables included resting systolic (SBP), diastolic (DBP), and mean arterial blood pressure (MAP) as well as the rate-pressure product ($RPP = SBP \times \text{heart rate}$). Given the association between body mass index (BMI) and BP in this sample ($SBP, r=0.50$; $DBP, r=0.43$; $MAP, r=0.50$; $RPP, r=0.23$), measurements were adjusted for BMI using regression procedures. Varying degrees of high BP were defined as the 75th, 85th, and 95th percentiles of age and sex-specific values. Standardized risk ratios (SRRs) comparing the age and sex-standardized prevalences of high BP in spouses and first-degree relatives of probands with high BP to age and sex-standardized general population prevalences were calculated. SRRs for the 95th percentile were 1.30, 1.47, 1.36, and 1.56 in spouses and 1.53, 2.53, 2.07, and 2.40 in first-degree relatives of probands for SBP, DBP, MAP, and RPP, respectively. SRRs decrease with decreasing percentile cut-offs used to define high blood pressure ($95^{th} > 85^{th} > 75^{th}$), and SRRs are higher in first-degree relatives than in spouses at each cut-off. The results suggest significant familial risk of high BP in the Canadian population, and the pattern of SRRs suggests that genetic factors may be responsible for a portion of the risk.

Regional cerebral blood flow in anaesthetized baboons (*Papio anubis*): the use of Positron Emission Tomography in anthropology. J.A. KAUFMAN, J. PHILLIPS-CONROY, Department of Anthropology, Washington University, MO 63130, K.J. BLACK, and J.S. PERLMUTTER, Mallinckrodt Institute of Radiology, Washington University School of Medicine, St. Louis MO, 63110

The physiology of the primate brain is critically important for understanding morphological and behavioral variation in extant species, as well as deciphering the evolution of the brain through primate lineages. Positron emission tomography (PET) offers a non-invasive, harmless form of in vivo autoradiography allowing comparative neuro-physiological research on a regional scale, thereby emphasizing the heterogeneous character of the brain.

Using ¹⁵O-labeled water, we measured regional cerebral blood flow in 20 anaesthetized baboons using PET. We then aligned these PET images with corresponding magnetic resonance images and transformed them into a stereotaxic digital atlas space for comparable sampling among individuals.

We found statistically significant left-right asymmetries in motor cortex

and sub-cortical regions of the baboon brain. These asymmetries are similar to published results of blood flow studies performed on humans, and may have implications for anthropological theories of handedness and laterality.

By exploring the brain's heterogeneity, PET forms the basis for further investigation in primate comparative neurology while offering anthropologists a new avenue to refine theories of primate behavior and brain evolution to reflect the complexity of this organ.

The oldest Argentine primates: first age determinations for the Colhuehuapian South American Land Mammal 'Age'. R. F. KAY and R. H. MADDEN, Biol. Anthropol. & Anat. Duke University; M. MAZZONI and M. G. VUCETICH, Univ. Nac. de La Plata; G. RE, Univ. de Buenos Aires.; M. HEIZLER, New Mexico Geochron. Res. Lab.; H. SANDEMAN, Geol. Sur. Canada

The oldest fossil primate in South America, *Branisella boliviana*, occurs at Salla, Bolivia in sediments dated to between 25.85 and 26.5 Ma (Kay et al., *J. Vert. Paleol.* 18, 189, 1998). Primates next occur in Chile where *Chilecebus* is dated at 20.09 ± 0.27 Ma (Flynn et al., *Nature* 373, 603, 1995). In Argentina, primates first appear associated with fossil mammals of Colhuehuapian 'Age' (SALMA) at Sacanana (*Tremacebus*), Gaiman (*Dolichocebus*), and at the Gran Barranca south of Lago Colhue-Huapi (an unnamed new monkey with possible affinities to *Soriacebus* of the early Santacrucian Pinturas Formation). At the Gran Barranca, the primate occurs in the upper part of the Puesto Almendra Formation, the boundary stratotype of the Colhuehuapian SALMA. New ⁴⁰Ar/³⁹Ar dates and a magnetostratigraphy constrain the age of the Colhuehuapian and clarify the timing of the oldest record of platyrrhines in Argentina.

Two series of dates have been obtained from samples collected within and one-half meter below the primate and principal Colhuehuapian mammal-bearing level at the Gran Barranca. ⁴⁰Ar/³⁹Ar dates from glass and plagioclase fractions are 19.87 ± 0.66 Ma and 19.57 ± 0.40 Ma, respectively. Biotite separates from another sample collected approximately 30 meters above the principal fossil-bearing level has yielded a plateau age of 20.9 ± 0.60 Ma. Paleomagnetic polarity results for this interval of the Gran Barranca geologic column indicate a sequence of two normal and two reversed intervals. The data suggest that the bulk of the Colhuehuapian fauna at Gran Barranca fits within Chron C6 (19.1 to 20.5 Ma), with the primate falling in Chron C6r, between about 20.1 and 20.5 Ma.

Thus, *Chilecebus* and the Gran Barranca primate are virtually the same (early Miocene) age. Elsewhere, the age of the Colhuehuapian fauna at Gaiman is constrained by the immediately overlying occurrence of a shark of Aquitanian from the marine Gaiman Formation (Chione, *Ameghiana*, 1997). Based on what is known about the chronology of the Aquitanian Age, *Dolichocebus* can be no younger than 20.5 Ma, nor older than 23.6 Ma. Supported by NSF grant to RFK and RHM.